REMARKS

The above amendments are presented in response to the Office Action dated September 21, 2007. Claims 119-169 are pending in the application. Claims 135, and 137-169 have been withdrawn. Claims 119-134 and 136 are rejected. Claims 119, and 125-128 have been amended. Claims 124 has been canceled. Support for the amendment to claim 119 can be found throughout the Specification, and specifically, in original claim 24 of the published application. Claims 125-128 have been amended to clarify claim dependency. Claim 126 has also been amended to further clarify the claim language. No new matter has been added.

Amendment and cancellation of the claims should in no way be construed as an acquiescence to any of the Examiner's rejections and was done solely to more particularly point out and distinctly claim the invention to expedite the prosecution of the application. Applicants reserve the right to pursue the claims as originally filed in this or a separate application(s).

In light of the claim amendments and the following remarks, Applicant respectfully request that the Examiner withdraw the rejections and pass this case to issuance.

Rejection of Claim 125 under 35 USC § 112, Second Paragraph

Claim 125 has been rejected under 35 U.S.C § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Specifically, the Office Action states that claim 125 is "indefinite because it is unclear which step applicant intends for the phrase "the method further comprises" to limit, or whether applicant intends to add a new step."

Applicants believe that the Examiner meant to reject claim 126 (not claim 125) since the recited phrase "the method further comprises" is not recited in claim 125. In response, Applicants have amended claim 126 to clarify the claim (by specifying it is the step of enzymatic coupling of

antioxidants and monomers that is further limited). Applicant thanks the Examiner for noticing this informality and respectfully requests that this rejection by withdrawn in light of the amendment.

Rejections under 35 USC § 103

Claims 119-134 and 136 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Kuczkowski (*Rubber Chemical Technology*, 1984, 621-651), in view of Vermeiren (*Trends in Food Science and Technology*, 1999, 10: 77-86), Yan et al. (*Biotechnology Letters*, 1999, 21: 1051-4) and Kobayashi (*Chem Rev* 2001, 101: 3793-3818). Applicants traverse this rejection.

As amended, claim 119 recites "*enzymatically* coupling an antioxidant to each of a plurality of monomers; and, enzymatically polymerizing the antioxidant-coupled monomers to form an antioxidant-coupled functionalized polymer". Support for this amendment can be found throughout the application as originally filed, and specifically in original claim 124.

The Kuczkowski reference merely teaches that antioxidants can be chemically bound to polymers, so that resultant rubber product have an increased susceptibility to deterioration from exposure to oxidative aging. Kuczkowski does not teach or even suggest the use of any enzymes of any kind.

The Vermeiren reference discloses the existence of active packaging. The paragraph cited by the Examiner (page 83, paragraph 1) points out that while vitamins E and C have been suggested for integration in polymer firms, their success is "difficult to access" since initial experiments showed that the migration from the film to the fatty food simulant was less than with BHT, a synthetic antioxidant commonly used as a food additive. There is no teaching or suggestion of integrating an antioxidant into the polymer backbone, or any teaching on how such integration could be done enzymatically, as recited in the claimed invention.

The Yan reference describes the synthesis of vitamin C esters using (activated) fatty acid vinyl esters. As described in the Yan reference, the use of vitamin C as *an additive* to foods and cosmetics has been limited based on it's hydrophilic behavior. Fatty acid esters of vitamin C

"improve the solubility and miscibility in a more hydrophobic environment" and therefore can be used as an *additive* in a wider variety of products. Yan does not disclose or suggest making a functionalized polymer with inherent antioxidant capabilities, as recited in claim 1.

Yan's contribution to the art is *improved solubility* of the antioxidant so that it can be *added* to a wider variety of products, such as food and cosmetics that contain fats or oils.

In contrast, the Applicants disclose a method of producing a functionalized polymer "in which the antioxidant [is] *immobilized* but yet fully functional" (See, paragraph [0005] of the published application). The Applicants explain the benefits of using an *immobilized* antioxidant that does not get added to the product in paragraph [0018] of the published application:

> The present invention has many benefits over known methods of antioxidant scavenging techniques. Antioxidants specifically coupled to monomer units ensure broad and effective dispersion of the antioxidant while eliminating the particle dispersion problem of emulsions or mixtures. *Since the antioxidants do not leach out of the polymer matrix, the compositions are non-staining, non-discoloring, non-toxic, odorless and tasteless*. Immobilizing the antioxidant also improves its long term stability.

Furthermore, Applicants' claimed method and Yan's approach are different. The Yan reference discloses acylation of vitamin C with long chain compounds. For example, in the Yan reference after enzymatic acylation with vinyl monomer, the *vinyl part of the molecule leaves* and the long chain part of the molecule is attached with vitamin C (See, Figure 1 of the Yan reference). In contrast, using the Applicants' enzymatic approach, the *opposite* takes place. For example, Applicants disclose that after the enzymatic acylation reaction with a vinyl monomer, the *vinyl part of the molecule is attached* with the antioxidant (e.g., vitamin C) and this vinyl-antioxidant moiety can then be polymerized in the second step of Applicants' method to produce antioxidant functionalized polymers (see, Figure 9 of Applicants' specification).

In summary, the role of vinyl group in Yan's approach is only to develop an activated ester. Using Yan's approach, one *cannot* produce vinyl monomers functionalized with antioxidants that can be further polymerized, as disclosed in the Applicants' claimed method.

Accordingly, there is no reason that a skilled artisan with knowledge of the Yan reference would be motivated to completely motify Yan's method to produce a functionalized polymer with inherent antioxidant capabilities, as recited in claim 1. In fact, such modifications would effectively thwart the functionality of the Yan's method (i.e., improving the solubility of vitamin C).

The Kobayashi reference merely teaches a method of enzymatically polymering monomers to form polymers using horseradish peroxidase. The Kobayashi reference does not teach the step of *enzymatically* coupling an antioxidant to each of a plurality of monomers, or the production of a functionalized polymer with inherent antioxidant capabilities, as required by amended claim 1.

There is simply no reason to combine the four cited references, and even if combined, each element of the claimed method is not disclosed. In order to satisfy the burden of obviousness in light of combination, there must be some reason leading to the combination, and the idea of combining them must flow logically from the teachings in the prior art. The invention should not be employed as a blueprint to simply pick and choose elements from different sources to defeat patentability. As recently emphasized by the Board of Appeals and Interferences "the unwitting application of hindsight" is inappropriate. *Ex parte So and Thomas* BPAI 2007-3967 (January 4, 2008) (The Board in *Ex parte So* at 5 stated "there is nothing in the applied references which would have motivated an artisan to select this particular ingredient and then use the resulting composition...")

Furthermore, in light of the unpredictable nature of the chemical arts, one of ordinary skill would not be motivated based on the combined teaching of the references to select the appropriate elements and run the experiments necessary to arrive at the claimed method. In fact, the cited art teaches away from such experimentation, which is an indication that one skilled in the art would not consider the Applicant's claimed invention "a routine matter of experimentation". For example, the Yan reference states that lipase-catalyzed synthesis of vitamin C esters has been "hampered by long reaction times or the use of solvents, which are not permitted for the manufacture of food related products" and that "[v]itamin C is very sensitive and easily undergoes oxidation, degradation and rearrangements. Even its esterified counterparts have to be handled carefully to avoid formation of

undersired by-products." (See, col. 2 page 1051, and page 1053, paragraph spanning col. 1 and col. 2).

In addition, the Yan reference emphasizes that separation of vitamin C esters "is not practical by simple extraction or separation and would require more laborious procedures, which might also affect the stability of the vitamin C esters thus lowering the yield." (See, page 1053, col. 2). Accordingly, the skilled artisan with knowledge of Yan would not be motivated to completely alter the Yan's method to reconstruct Applicant's method. In fact, there is no reasonable expectation that such alteration would successfully result in Applicant's claimed invention since vitamin C easily degrades, and the extraction and separation of vitamin C esters is complex and results in low yields.

In light of the above remarks, the Examiner is respectfully requested to withdraw the obviousness rejections.

Conclusion

In view of the foregoing remarks, reconsideration of the rejections and allowance of all pending claims is respectfully requested. In the event that the claims are not deemed to be in condition for allowance, the undersigned again requests an opportunity to interview with the Examiner. If a telephone conversation with Applicant's Attorney would expedite prosecution of the above-identified application, the Examiner is urged to call Applicant's Attorney at (617) 439-2948.

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Respectfully submitted,

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